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A TECHNICAL ASSESSMENT OF THE GENERIC MODELLING UTILITY

By

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and
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ABSTRACT

The Generic Modelling Utility (GeM) is a software package developed by the Department of National Defence for producing military human resource (HR) simulation models. Career flow modelling of Canadian Forces (CF) occupations, as conducted in GeM, has achieved a great deal of acceptance among HR planners and career managers. However, the GeM software has proven to be somewhat problematic to support and difficult to learn. This paper presents an analysis of GeM functionality and makes recommendations about its continued use as a modelling tool for the CF.

RÉSUMÉ

L'utilitaire de modélisation générique (GeM) est un progiciel développé par le ministère de la Défense nationale pour produire des modèles de simulation propres aux ressources humaines (RH) militaires. La modélisation du roulement professionnel au sein des Forces canadiennes, produite à l'aide de GeM, est maintenant bien acceptée des planificateurs des RH et des gestionnaires de carrières. Cependant, le soutien et la formation liés au logiciel GeM se sont avérés respectivement problématique et difficile. Le présent article comprend une analyse de la fonctionnalité de GeM et des recommandations sur l'utilisation continue par les FC du logiciel comme outil de modélisation.

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A TECHNICAL ASSESSMENT OF THE GENERIC MODELLING UTILITY

I. INTRODUCTION

Background

1. The Generic Modelling Utility (GeM) is a software package developed by the Department of National Defence (DND) for producing military human resource (HR) simulation models. Since the early 1990's GeM has been used primarily to determine the effects of proposed HR policy changes on the structure and demographics of the Canadian Forces (CF). HR modelling requirements in the CF and other militaries differ from most other organizations due to their unique hiring, promotion, and retention policies. For example, hiring must occur through recruitment at the most junior ranks and, for all practical purposes, more senior rank is only achievable through promotion.

2. DND's Directorate of Manpower Analysis (D Man A) first developed GeM in the early 1990s. At the time there were four different models in use to examine personnel policies for the CF. All of these models had become difficult to maintain due to the extensive reprogramming required to represent a broader range of analysis support than had previously been the case. There was a need for a more flexible software environment to replace some or all of their existing models. [1]

3. The need for a new modelling approach reached a critical level when an impact analysis was required for a proposed career progression process known as Trade Advancement through Skill and Knowledge (TASK). TASK models would have to represent career flows with both upward and lateral flows (i.e. through promotion and/or technical knowledge) as opposed to the simple upward rank progression of other D Man A models. Such HR models would also have to support structural differences between different military occupations (MOCs) as well as different promotion and attrition patterns. These occupational structures

may become quite complex as career progression may be affected by flows between MOCs at split or merge points [1].

4. To address these issues a commercial organization was contracted to design the initial specifications for this unified modelling environment while another consulting group did the majority of the software development. More recently, an independent consultant, formerly of the latter consulting group, has been solely responsible for the last few versions of GeM. The most recent issue of GeM is version 6.

Aim

5. This paper presents a detailed analysis of GeM functionality and provides recommendations about its potential continued use as a HR modelling tool for the CF.

II. GeM FUNCTIONALITY

6. The initial specifications of GeM were for "a manpower career progression model which demonstrated immense flexibility for modifying scenarios" [1]. D Man A eventually developed a time-stepped simulation model concept involving "nodes" and "links" that forms the foundation of GeM models.

7. Nodes represent states that correspond to attributes of individuals such as a particular rank, engagement type, time in rank (TIR), year of service (YOS), etc. Typically, individuals within the node all share the characteristics defined by the node. Thus a "Corporal" node would contain everyone at the rank of Corporal, while a "Basic Engagement" node would contain everyone currently on a "Basic Engagement". These two characteristics are not mutually exclusive as an individual may share both characteristics and therefore be in both nodes simultaneously.

8. Links represent the flow of individuals from one state to another, and are therefore generally connected between nodes. Intuitively, links connect nodes that represent characteristics that change in line with the business policies of the organization. For example, a link from a "Private" node to a "Corporal" node corresponds to the actual promotion flow between ranks. However, a link from a "Private" to a "Major" node makes no sense because there is no such promotion possible within most military organizations. Moreover, a link between a "Private" node and a "Basic Engagement" node makes no sense because rank and engagement type are entirely different characteristics. There are also several special types of links with enhanced functionality to suit specific purposes. For example "entry" links create new individuals to simulate recruitment processes and "exit" links remove existing individuals to simulate attrition.

9. Groups of connected nodes and links are organized into "overlays", several of which can exist in the same model. In practice, each overlay represents a node/link group corresponding to a particular characteristic. For example, a rank overlay will have nodes and links relating only to rank levels. Multiple overlays allow for the modelling of distinct but related criteria. Thus, since the CF has a system of distinct, yet related, rank and contract structures, each can be modelled in a separate overlay. It is this capability for mapping network flows of multiple distinct criteria that originally made GeM more advanced than other software of the time.

10. At runtime, a GeM model uses historical flow patterns to "guess" what will happen to individuals in the system. For example, people in the model are assigned historically derived probabilities for various events such as promotion and attrition. Specifically, if 10% of Captains in an occupation and at a particular YOS, etc. had been promoted to Major in the past, each Captain matching those criteria is given a 10% chance of being promoted. A danger in using historical patterns to assign transition rates for the future is clear, should actual flows deviate from the norm. In fact, when sponsors require it, historical flow rates can

be modified to better reflect anticipated changes. In practice, many of these flows have been consistent in the past and there is little specific evidence of any major deviation from historical patterns for the immediate future. For example, attrition has always been much higher for new recruits and for personnel who become eligible for a pension than for the rest of the CF population.

III. VALIDITY

11. How valid are GeM model results? According to the US Department of Defense (DoD), the validity of a model can be determined through a process known as Verification and Validation [2]. The definitions provided for the two terms are condensed as follows:

a. *verification* determines whether or not the internal structure of the model actually works; and

b. *validation* determines how accurately the model depicts reality.

Verification

12. Since the internal components of GeM have only undergone minor changes since its original creation and regular use indicates that models produce justifiable results, there is some confidence that the internal structure of the software is working properly.

13. Historically, there have been few problems detected within the internal structure of GeM simulation models. However, issues have surfaced with the manner in which individuals are selected for movement through GeM simulations. Although GeM conceptually stores individuals within nodes, it actually maintains a database of all the individuals in the system and simply scans top-down through this list to find the appropriate number of individuals matching the necessary characteristics required for any particular process such

as promotion, attrition, contract conversion, etc. This mechanism results in the individuals at the top of the database being promoted to irregularly high levels while individuals near the bottom remain stagnant. In recent versions of GeM, this oversight has been fixed with GeM users being given the option to store individuals directly within nodes. This change does result in longer model processing times.

14. More recently, the capability has been implemented to separate individuals into distinct groups, with varying probabilities of being moved through the link assigned to each group. While considerably faster than storing individuals within nodes, it is still slower than top-down scanning.

Validation

15. The problem of validation can be broken into two issues. One is ensuring that the rules and structures representing the CF "HR environment" are faithfully replicated. The other is ensuring that the initial data in the model represent the current state of the CF population.

16. Ensuring that CF HR policies are properly depicted is something that is done on a case by case basis for each GeM model. Problems with any particular model are likely the product of user error and not necessarily indicative of a problem with the GeM environment itself. However, in some cases improved user interfaces may reduce the likelihood of user error.

17. Military personnel are promoted based on historical rates and preferred manning levels (PMLs) which, while prone to change, are the most reasonable data available. Attrition and intake are also based on historical rates. As noted, the danger in relying on historical rates is that these may not be applicable in the future. While GeM models are flexible enough to allow different rates to be

specified, the usual assumption made is that the overall pattern of promotion, attrition, and intake will not change drastically from historical norms.

18. GeM models must also accurately represent initial state CF population characteristics. Having grossly incorrect initial data will logically lead to grossly incorrect output. Originally, data were obtained from the CF Military Personnel Information System (MPIS). Formerly, GeM modellers had the capability to extract customized historical data directly from this system. MPIS was recently replaced with a more modern Human Resources data system known as PeopleSoft where historical information would be stored at frequent intervals in a data warehouse known as Datamart. Unfortunately the backfitting of the data from MPIS did not occur smoothly and consequently the data transferred to Datamart are considered somewhat suspect. Fortunately, precautions have been made to retain 15 years of historical data within the Personnel Operational Research Team (PORT) [3].

19. In the past year, PeopleSoft records have continued to be of poor quality, requiring a great deal of cross-comparison and data correction to be made useable. Estimates of the error rate in PeopleSoft HR data are as high as 6%, although it is expected that this may decline as faulty records are deleted and newer records added.

IV. RELIABILITY

20. The reliability of GeM models is of paramount importance. If two different runs of an identical model produce drastically different results, GeM's use as a forecasting tool would certainly be questionable.

21. Since computers are unable to create truly random numbers, most software involving processes that need to be randomized resort to using an

arbitrary number placed through what is known as a "randomization" process. Thus one number can generate a series of random numbers. The initial number is known as a random number seed, and most current software products generate the seed from the clock (by taking, for example, the milliseconds from the clock), although some software (particularly scientific products) are similar to GeM in that the seed must be entered manually.

22. Short project deadlines and long execution times required for GeM simulations rarely allow a model to be run more than once. The fact that GeM relies on random numbers for simulating personnel flows makes it highly unlikely that any two runs of the same model will generate perfectly identical results. Thus testing the level of variability between different runs of a GeM model is necessary to establish the reliability of any future results.

23. A recent PORT study examined this issue by running a typical GeM officer model (i.e. Air Equipment Controller) one hundred times with different random number seeds to determine what results from GeM models were more stable than others [4]. Since most GeM models share similar characteristics, any instability found in that particular model would also be found in other officer models. That study found that measurements of a population (such as average age and average years of service) had a low level of variability. However, measurements of personnel flows (such as intake and promotions) had a high level of variability between runs, although the variability approached constant limits if the release rates and promotion zones were assumed to remain constant. The study warns GeM model users to interpret single run results carefully and suggests ways for extracting better estimates from single run information. Despite this particular study, questions still linger about the overall statistical validity of running GeM models only once and not averaging over a series of multiple randomized iterations. This problem is currently being addressed in the latest GeM software development.

V. ACCESSIBILITY

24. The user interface is both one of the most important and one of the most ignored aspects of software design. For our purposes a "user-interface" refers to the functionality within software that permits user interaction. Without a good user-interface, even the most brilliant piece of software would find itself with extremely unproductive users. The benefits of a good user-interface are best described as follows:

> "when an interactive system is well designed, the interface almost disappears, enabling users to concentrate on their work, exploration, or pleasure." [5].

Thus, whenever possible, a user-interface should become easily transparent to the user. While GeM is more capable than many commercially available modelling packages, its capabilities are also hampered by a complex user interface.

25. Early versions of GeM did not have a visual user interface yet were still able to produce effective models because users had experience with the process of conceptualizing personnel flows. It was later decided to develop a graphical user interface in the interests of making GeM easier to use and easier to learn[1]. In fact, this may have had the opposite effect.

26. The concept for the GeM user interface was fairly straightforward in that the representation for nodes and links would be made visible to the user. Since the concepts behind the modelling were also not difficult to grasp, it was believed that the new interface for the software would make it easier to use as well as

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[1] It can be argued that GeM should not be a widely used tool due to the difficulty in detecting (human input) errors in models. However, ease of use does not necessarily suggest much more widespread use. Individuals capable of understanding the processes that GeM uses should be able to use the software and that is not currently the case.

useable by wider range of people. The improvements would make it easy to create nodes with the click of a mouse and drag links between them.

27. Shneiderman describes three types of end users for software: *novice users*, *knowledgeable users*, and *power users* [5]. With some slight adjustments to frame the discussion in the context of HR modelling, these distinctions can be described as follows:

a. *Novice users* have little knowledge of the system and little knowledge of HR modelling. In these cases restricting complex vocabulary, providing clear feedback on actions, and simplifying the performance of basic tasks is paramount. Since the requirement for knowledge of HR modelling processes has been explained it is likely that novice users should not be the target audience for the software.

b. *Knowledgeable users* are those who are quite familiar with the processes behind modelling and some computer concepts, but cannot necessarily recall how to perform complex tasks. These users can be helped through the use of a simple user interface that is both consistent with itself and with other commonly used software. They can also benefit from well-organized reference manuals and online help screens to provide missing syntactic or semantic information.

c. *Power users* are familiar with both the system and the processes behind modelling. They know exactly what they want the software to do and are concerned with getting the software to do it as quickly and as easily as possible. These users will be helped by "rapid response times, brief and less distracting feedback and the capacity to carry out actions with just a few keystrokes or selections" [5].

28. Given the specific nature of the tasks GeM is required to perform, it is highly unlikely that novice users will be expected to efficiently operate GeM.

Thus while certain aspects of a novice user interface would certainly be beneficial for beginning users, it would appear that the focus of the user interface structure should be on *knowledgeable* and *power users*.

29. Most user-interface studies suggest the creation of software that is friendly to users and geared towards their particular needs. However a given piece of software that may have multiple users may also be subject to a variety of requirements which themselves may evolve over time [6]. For GeM development there need only be one sort of user seriously considered - the modeller. It may be assumed that the modeller will initially be a *knowledgeable user* although exceptions are possible (e.g. new recruits, transfers, etc.). Some modellers may even progress over time to become *power users*.

Flexibility & Complexity

30. Critical to user interface design is the choice between flexibility and consistency. On one hand flexibility allows users to do what they want when they want and also maximizes potential use of a piece of software. On the other hand consistency allows new users to learn effectively and limits the potential for human error. The key to a good user interface lies in balancing the two. Excessive functionality is

> "...a danger because the clutter and complexity make implementation, maintenance, learning and usage more difficult." [5]

31. In GeM development, the focus has been placed more on the side of flexibility. Although GeM can be used to simulate virtually any flow/dynamical system (such as the dynamics of a combustion engine), it has in practice only been applied to HR studies. If GeM had been designed for non-HR applications its extreme flexibility might be useful. However, it was designed specifically as a HR modelling tool [7].

32. The initial rationale behind expanded flexibility was that it would be impossible to predict any future HR policy changes, so the resulting software should be as flexible as possible. As it turns out, this philosophy may have been taken too far and, despite the flexibility present in GeM, there are limitations on what sort of policy changes should be modelled. Since GeM is essentially a network flow tool, policy changes involving shifts in a network flow can be easily represented within this environment. Anything not impacting a flow somewhere in the HR process in a predictable manner would likely be difficult to model with GeM.

33. Another difficulty with the user interface may have to do with the complexity of the underlying mechanisms for GeM. However it is important to note that the underlying mechanisms and the user interface need only be conceptually connected. If users can visualize a model in their minds or on paper it should be just as easy, if not easier, to create the model on a computer. The early designs for GeM even recommended that the user interface and the inference engine remain completely separate, with the interface producing instructions for the engine to run. [7] [8]

34. GeM models are also difficult to document upon creation. Since certain types of models can become extremely complex, the absence of documentation makes existing models even more difficult to understand. Not only would good documentation allow users to better understand models created by others but it would also help users understand their own models, particularly if the models become complex or have not been used recently.

> ".. the most critical aspect of software development is the creation of excellent documentation." [9]

It should be pointed out that the benefits of better model documentation would be lost if subsequent GeM model users failed to take advantage of existing

documentation. GeM model developers and users should be strongly encouraged to properly document their models.

35. GeM's object structure does not obviously allow for one of the most important aspects of object-design, *data hiding*. Also known as compartmentalization, *data hiding* is what allows one object to restrict the operation of other objects. While this may seem counter-productive it greatly reduces the chance for human error. The most obvious benefit of *data hiding* is that it prevents users from making mistakes based on improper syntax.

Commonality of User Interface Elements

36. One of the most notable user interface flaws with GeM is the lack of similarity between its user interface and that of other software. Including familiar elements in the interfaces for different software allows for faster learning and a greater overall degree of efficiency as users adapt to the required performance levels. Even

> ".. slight differences among systems not only increases learning times, but can lead to annoying and dangerous error." [5]

37. Since the GeM software is currently used in the Microsoft Windows 95/NT and Microsoft Office environments, it makes sense to attempt to emulate aspects from these software suites whenever practical. The user interface currently fails to fit this demand and in fact violates many standard Windows 95/NT conventions. These conventions are included in Annex A.

Miscellaneous

38. Many aspects of GeM's operation are inherently counter-intuitive. Certain windows absolutely require keyboard interaction while others absolutely require the mouse. The "Undo" commands are not placed in a standardized location and are not easily accessible, nor are they functional. An "Undo" command would be extremely useful since it would allow novice GeM users the freedom to explore without fear of causing irreversible harm to a model.

39. In an ideal user interface, keyboard use is supported for almost everything. The keyboard allows immediate action and is not based on any input device state, unlike the mouse whose response time is often largely dependent on where the cursor is located. For this reason, it would be practical to not require the use of a mouse for every operation. Unfortunately, GeM often requires the user to return to the mouse and select a series of buttons after typing input for a field. For repetitive tasks this becomes quite arduous.

40. The GeM environment produces an abundance of warning messages for a variety of reasons. Among these are warnings regarding:

a. unexpected input;
b. fatal errors; and
c. notification of events that have taken place.

The need to keep the user informed as to what is occurring is important but must be balanced with the need to not interfere with the basic operation of the program. Thus certain non-critical messages should be displayed without requiring user input to continue. Warning dialogs might also be made more descriptive in nature or avoided altogether for major events that occur regularly. The danger in vague error messages is that they may cause the user to panic and lose trust in the system.

> "Users' trust of systems is fragile, one experience with unexpected results will undermine a person's willingness to use a system for a long time." [5]

41. There is no clear file/environment distinction within GeM's user interface. In other words the interface makes it unclear as to whether changes to program settings affect a particular model file or whether they affect the model construction environment as a whole. To clarify, in GeM the file/environment paradigm can be expressed in terms of a model/run. One model may be run multiple times. A model can be set to run for four years, five years, or a hundred years. The internal characteristics of the model are blind to the parameters

under which it is being run. Thus a model running for four years which is later rerun for five years maintains the same structure. Conversely, nodes and links can be edited in a model. These changes have no impact on the parameters for any individual run. However, GeM's user interface does not sufficiently compartmentalize the two elements of the file/environment paradigm and users are left unsure as to whether a particular change affects the model or the run.

42. Difficulties arise when it is not clear which parameters are stored "in the run", "in the model" or "not stored at all". A novice GeM user might look at the "quiet goal mode" and "enable animation" options in GeM and assume that these parameters, once set, will affect any subsequent runs. This is not the case, as these "local" settings must be selected each time a GeM model is loaded. They are not stored "in the model" nor are they "run parameters". There exists a separate, distinct window for configuration of the run parameters. In some cases it appears as though changes to a configuration in the environment require the program to be saved prior to being effective (thus the change in configuration appears to be part of the GeM model - but this is not so).

VI. DEVELOPMENT

Cost Benefits

43. Career flow modelling of CF occupations, as conducted in GeM, has achieved a great deal of acceptance among personnel planners and career managers. It is a routine part of the analysis supporting occupational restructuring, a tool for investigating the policy alternatives for Annual Military Occupational Reviews (AMORs), and has provided short term guidance in the setting of intake and Canadian Forces Career Development Plan (CFCDP) gate levels to meet occupational objectives. More recently, GeM models have been applied to support more strategic policy development (e.g. [10] to [14]).

44. It is difficult to determine the cost-benefits of employing GeM models to support HR policy development. It could be argued that results from one model alone could potentially save the CF the entire cost of developing and running GeM (e.g. reduced HR training and development costs). However since decisions are not made based on GeM models alone, the gain from appropriate actions by senior management cannot be attributed strictly to GeM.

45. Benefits derived from running GeM models may not directly relate to costs. GeM model results can and have been used to suggest actions that have served to "improve" MOC demographics, equalize promotion flows, substantiate re-engineering and re-structuring initiatives, reduce voluntary attrition, and assess entry plan intake options. GeM models have contributed to several "Quality of Life" initiatives.

Methods

46. GeM fundamentally consists of two separate pieces of software. One is a user-shell that allows the graphical development of models and the instructions for running the models. The second piece is an inference engine that takes the files developed by the shell and produces GeM model results. The results can, in turn, be viewed in the user-shell. The presence of two parts is essentially seamless as the user-shell can run the inference engine internally.

47. Both the user-shell and the inference engine are developed in Prolog, an inference language. Inference languages simplify the process of programming complex relationships between ideas. An inference language program is written as a series of facts and rules. Inference languages differ from functional languages in that a functional language program is written as a series of instructions. Thus developing a routine to solve a decision tree is often much easier in an inference language than it is in a functional language. Because of the self-contained nature of individual inferences within the languages, they are usually easier to test but sometimes harder to debug. [15].

48. Outside the academic field of Artificial Intelligence (inclusive of Expert Systems and Knowledge Based Systems), inference languages are not in common use in North America. Although certain corporations make widespread use of languages such as Prolog, it is becoming increasingly difficult to find industry developers with extensive experience in inferential development. Consequently the development and maintenance of software written in inference languages, such as Prolog, may be more expensive than software written in conventional functional languages such as C, Java, Delphi, etc.

49. The full capabilities of the inference engine within GeM have never been tapped. The engine has the capability to develop policy and make recommendations instead of simply predicting the results of policy. This functionality has not been used recently because of limited resources, user unfamiliarity, project time constraints, etc. The inferential capabilities of the engine are currently only being used as a form of search and replace where setting a rule inferentially does the equivalent of changing many static variables.

50. If the capabilities of an inference engine are not necessary, future versions of GeM could make use of a simpler processing engine. This would eliminate the need for GeM users to have any knowledge of Prolog in order to develop models. While this would remove the inferential language capability of the software, the overall flexibility could be maintained by using a post-processor in a different language, particularly one with a wide developer/user base in industry.

51. To maintain software portability, the use of a standardized multi-platform software language is important. If GeM were to be re-written it might be worth analyzing new developments in portability, such as cross-platform executable languages such as Java.

52. The absence of an effective visual environment in the version of Prolog originally used by GeM's developer has hampered the subsequent integration of

basic elements of a modern visual user interface. Features that are easily developed in visual environments took much longer to code since they make use of "experimental" visual interface libraries. User interface changes can be made quickly in languages with visual design components, while GeM user interfaces have proven to be expensive. More recently, the stability of the visual interface environment for Prolog appears to have improved and is becoming more readily available.

53. It should be pointed out that there is no reason for the user-shell to be written in the same language as the inference engine and that regardless of other changes considered, rewriting the user-interface to capitalize on visual capabilities of other languages is always a possibility.

VII. CONCLUSIONS

54. GeM is a complex network flow simulation building tool that has proven its effectiveness in supporting the development and application of CF HR policies. It has a respected reputation among those who use its results. However, GeM has proven to be difficult to learn and recent GeM software developments have resulted in poor correspondence with supporting documentation. The absence of clear, well written, on-line and off-line documentation makes it difficult for users to learn "on their own".

55. In some cases GeM models are used when simpler models may suffice. While GeM may capture more of the actual flow dynamics of a MOC or group of MOCs, it may occasionally be more expedient to use simpler modelling techniques. It is important that these techniques not be strictly code-based or unnecessarily complex in order to avoid costly maintenance.

56. Some doubts exist regarding the statistical validity of running GeM models only once. Original documentation noted that GeM would be run in a Monte Carlo fashion but this is not being done and consequently the statistical reliability of GeM model results is suspect. However, progress has been made in addressing this issue in the latest release of GeM.

57. It appears that in certain areas, technology has clearly overtaken GeM. Once considered state-of-the-art, GeM has either passed or is quickly approaching the point of obsolescence, with respect to its internal data handling and its user interface. Recent advances have been made in improving the user interface within GeM but it is quite likely that a new user interface may have to be developed in a different language.

VIII. RECOMMENDATIONS

58. A new review of the functional requirements for GeM should be conducted to determine what exactly is required of the software. In particular, it should be determined whether the product will be used outside the field of HR modelling, who the end users of the product are, and what costs might be incurred in training GeM users. It should also be determined whether artificial intelligence capabilities should be supported in the software.

59. A further study of modern network flow tools should be done to confirm that commercial software with capabilities similar to those required of GeM do not already exist.

60. A HR modelling methodology study should be done by experienced analysts not involved in the GeM software development process. The results of this independent review should clearly determine what methods GeM models should use as well as under what conditions and for what purposes GeM models

should be used. The results of this study should influence the decision regarding whether or not to rewrite GeM.

61. Based on the above studies and the availability of appropriate software, a decision should be made as to whether or not the GeM software should be re-written wholly or in part. If rewritten, steps should be taken to ensure that GeM or its successor(s) remain thoroughly documented as development occurs.

62. Regardless of the methods chosen, more attention should be paid to the software life-cycle and regular literature reviews should be conducted whenever possible to ensure that tools used for modelling have not become outdated.

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ANNEX A to
DOR(CAM) Research Note 9907
Dated May 1999

LIST OF USER INTERFACE DIFFERENCES

A1. This Annex lists discrepancies between commonly used software and GeM Version 6.0 Pre-Release - the latest version of the software available. The purpose of this Annex is not to list errors or most effective ways of performing tasks. It addresses the issue of differences between GeM and popular software. This may help to minimize the overall learning time for new users as well as increase effectiveness for all users.

A2. Since Microsoft Office 97 is the DND standard software suite, it has been used as the benchmark.

"Options"

A3. Most commercially available software packages tend to include an "Options" option under the "Tools" menu to adjust global variables in the program, irrespective of the individual file. On the other hand the "Properties" option on the "File" menu can be used to adjust the properties unique to the file. GeM has its own "Options" heading which has its own sequence of options beneath it. The nature of the options leaves users unsure as to whether the options refer to the model file or options contained globally within GeM. The words "save preferences" and "load preferences" are also included as options at the bottom, instead of "save options" and "load options".

"File Save"

A4. Common practice is that when a file is saved in a particular format, not specifying a file extension results in the default file extension being applied to the file. In GeM, when the option "save preferences" is chosen from the "Options" menu and a filename is given without an extension, the typical extension (.gpf) is

not attached to the file. Thus attempting to load a file (which by default only shows .gpf extensions) will not show the recently saved file unless the file selection dialog is adjusted to show all files. The same problem exists elsewhere, although a *.ext is placed as the default string where "ext" is the appropriate extension.

Preferences

A5. In most software applications, when preferences for a program are saved, they are automatically loaded upon running. In GeM, preferences for a program are not, or do not appear to be, automatically loaded upon running.

Start-up

A6. For most commercial software applications, users can begin working immediately. Upon loading GeM, users are unable to modify the visual environment and cannot create objects from the toolbar. They are required to load generic files first although this is never explained in any dialogs. There is no option to automatically load a generic file.

"Wizards"

A7. Generally, wizards are contained within the software applications themselves, irrespective of what files are loaded. In GeM, one generic file supports wizards while another does not. Files based on the non-wizard generic file can never support wizards.

"Undo" – "Redo"

A8. In most software applications "Undo" and "Redo" options appear under an "Edit" menu. In GeM, the undo and redo buttons are labelled with diagrams and appear on a toolbar above no window.

A9. In most software applications, when selected, "Undo" undoes the last action performed. "Redo" re-performs the last action undone. In GeM the undo and redo buttons are not functional.

Menu Bar

A10. Most commercial software has a "File" menu bar with "Load", "Save", "Save As" and various other options. GeM has a "Models" menu bar with a "Model files and Attributes" option. This option expands into a sub-menu with saving, loading, and merging as options.

Field Editing

A11. Common practice in software design has changing the contents of a field accomplished in a normal text editor (i.e. contents can be deleted or highlighted and overwritten, etc.). The format of a field can be changed concurrently with the dialog. Fields are often assigned values intelligently, or given a commonly used default value for simplicity.

A12. In GeM, changing data in a field can only be done by selecting a "Zap" button. Clicking the "Zap" button leaves the value at null and immediately exits the dialog, forcing the user to re-select the field if a new value is needed. Entering new data requires the selection of a field format from a list of many. Only after this has been done can the new value be entered. There is no intelligent monitoring to guess the appropriate field format.

"File Dialog" Save

A13. Most commercial software allows the user to save work after something is written in a "file dialog" and the "file dialog" is closed. In GeM, when a visual dialog box is opened, used and then closed, there is no mention of saving the scene. This can lead to the accidental deletion of important work. When the GeM environment itself is closed, the user is asked if they are sure they want to quit, but no mention of saving the work is included.

Edit Boxes

A14. In edit boxes, common practice is to do cutting, copying, and pasting with CTRL-X, CTRL-C, and CTRL-V respectively. GeM uses older DOS convention shortcuts that are not labeled anywhere in the program.

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The Generic Modelling Utility (GeM) is a software package developed by the Department of National Defence for producing military human resource (HR) simulation models. Career flow modelling of Canadian Forces (CF) occupations, as conducted in GeM, has achieved a great deal of acceptance among HR planners and career managers. However, the GeM software has proven to be somewhat problematic to support and difficult to learn. This paper presents an analysis of GeM functionality and makes recommendations about its continued use as a modelling tool for the CF.

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